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PATENT & TRADEMARK OFFICE

Practitioner's Docket No. U 014927-8

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: John Warner JARMAN
Serial No.: 10/727,115
Filed: December 3, 2003
For: ROTARY HEAT ENGINE

Group No.: 3748
Examiner: H. Nguyen

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF CERTIFIED COPY

Attached please find the certified copy of the foreign application from which priority is claimed for this case:

Country: Zimbabwe

Application Number: 1/2003

Filing Date: 6 June 2003

WARNING: "When a document that is required by statute to be certified must be filed, a copy, including a photocopy or facsimile transmission of the certification is not acceptable." 37 C.F.R. 1.4(f) (emphasis added).

CERTIFICATE OF MAILING (37 C.F.R. 1.8a)

I hereby certify that this correspondence is, on the date shown below, being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to the Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450.

Date: December 21, 2004

Signature

William R. Evans
(type or print name of person certifying)

SIGNATURE OF PRACTITIONER

Reg. No.

William R. Evans, 25858, (212) 708-1930
(type or print name of practitioner)

Tel. No.: (   )

P.O. Address

Customer No.:

c/o Ladas & Parry LLP
26 West 61st Street
New York, N.Y. 10023

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent, if the foreign application is referred to in the oath or declaration, as required by § 1.63." 37 C.F.R. 1.55(a).

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CERTIFIED COPY OF
PRIORITY DOCUMENT

CERTIFICATE

This is to certify that the documents annexed hereto are true copies of:

- Patent Application forms P1, P5 and P10
- Provisional Specification of Zimbabwe Patent Application No.1/2003 as originally filed in the Republic of Zimbabwe on the 6th day of June 2003 in the name of John Warner Jarman for an invention entitled "ROTARY HEAT ENGINE"

Signed and Sealed at Harare this 5th day of October 2004

CONTROLLER OF PATENTS

ZIMBABWE

Form P.1

Sections 6, 7 and 26 of the Act
Section 3 of the regulations

PATENTS ACT, CAP. 26:03

Application for a Patent
(Non-Convention)

BEST AVAILABLE COPY

I, John Warner JARMAN

Citizen of Zimbabwe

of 257 Chiremba Road, Hatfield, Harare, Zimbabwe

do hereby declare :

1. That I am the owner of an invention in respect of ZIMBABWE by having invented it ~~acquired it by assignment~~ and which invention is described in the accompanying complete specification under the title -

EXTERNAL HEAT ENGINE

2 That I claim to be the inventor thereof.

3 ~~That I/we are the assignee(s) of :~~

4 That to the best of my knowledge and belief, the statements made above are correct and there is no lawful ground of objection to the grant of a patent to me on this application, and I pray that a patent may be granted to me for the said invention;

And I request that all notices, requisitions and communications relating to this application may be sent to :

HONEY & BLANCKENBERG
Throgmorton House
P O Box 85, Harare

~~whom I hereby appoint, with power of substitution, to act for me in all matters relating to this application and any Letters Patent granted thereon.~~

DATED this 6th day of January 2003

for Honey & Blanckenberg
AGENTS FOR THE APPLICANT

The Registrar
The Patent Office
Harare

Z I M B A B W E

Form P.10

Section 12(1) of the Act
Regulation 11

<u>Fee: $500.</u>

PATENTS ACT, Chapter 26:03

Request for the Post-dating of an Application

I, John Warner JARMAN

of 257 Chiremba Road, Hatfield, Harare, Zimbabwe

hereby request that application No. 1/2003 lodged on the 6th day of JANUARY 2003, be deemed to have been made on the following date, namely, the 6th day of JUNE 2003.

Dated this 6th day of January 2004.

REGISTRAR OF PATENTS, INDUSTRIAL TRADE MARKS, DESIGNS AND COPYRIGHTS
- 6 JAN 2003
P.O. BOX CY 177, CAUSEWAY
HARARE, ZIMBABWE

for HONEY & BLANCKENBERG
Agent(s) for Applicant(s)

My/Our address for service is : Honey & Blanckenberg
Throgmorton House
51 Samora Machel Avenue
Harare

The Registrar
The Patent Office
Harare

ZIMBABWE

FORM P.5

Sections 8 and 9 of the Act
Regulation 3 (2)

Fee : $5000.

PATENTS ACT, CAP. 26:03

Complete Specification filed in Pursuance of Provisional Specification

TITLE OF INVENTION : **ROTARY HEAT ENGINE**

I, **JOHN WARNER JARMAN**

a citizen of Zimbabwe

of 257 Chiremba Road, Hatfield. Harare, Zimbabwe

do hereby in the following complete specification fully describe the invention and the manner in which and the best method by which it is to be performed :

ROTARY HEAT ENGINE

ABSTRACT

The engine consists of an annular array of chambers (hot leg), individually connected to an adjacent continuous condenser (cold leg), and containing a quantity of working fluid and gas - the gas usually being the fluid's own saturated vapor. When a temperature differential exists between the chambers and condenser - either by means of heat being applied to the chambers or cooling being applied to the condenser, or both - a resultant difference in vapor pressure is created; and while fluid within chambers on one lateral side is forced into the condenser, the positioning of the interconnecting ducts allows fluid to run freely from the condenser into chambers on the opposite upper lateral side. The weight imbalance and resultant torque created by such displacement of fluid causes the whole device to rotate, together with the axle to which it is secured.

FIELD OF THE INVENTION

This invention relates to a rotary heat engine in which a volatile liquid is boiled or a gas heated, such as by heat from the sun, to unbalance liquid in an annular array of chambers to cause the array to rotate.

There is a constant demand in many remote rural areas, particularly in the third world, for engines that can operate pumps, generators and grinding wheels etc., and that:

1. require no fuel;
2. are reliable and easy to maintain;
3. can be easily constructed by persons with reasonable relevant skill;
4. are competitive in price, performance and ease of installation with wind and photovoltaic devices;
5. cannot stall;
6. are self-starting;
7. contain no internal valves, springs or diaphragms, etc., which can jam or fail;
8. can operate in darkness and through a wide range of weather conditions.

The present invention complies with all the aforementioned requirements.

Rayboy's US patent No. 4,141,218 utilizes radiant heat and consists of a sealed rotating drum, partly filled with liquid within which trapped gas bubbles are heated and thereby expanded on one lateral side, resulting in liquid displacement and torque. Lapeyre's US patent No. 3,984,985 contains gas-filled bellows which are alternately heated and cooled with the resultant expansion and contraction causing displacement of surrounding fluid. Some engines use a heating bath into which rotating lower containers are immersed (Schur's US patent No. 4,121,420, Gulko's US patent No. 4,012,911, Myers' US patent No. 4,195,483); while many utilize one or more mechanisms such as bellows, non-return valves, cams, springs, rods, diaphragms etc., (Schur, Gulko, Myers, Lapeyre, Gould's US patent No. 4,570,444). However these previous inventions, together with others examined, all operate upon one or more of the following limiting conditions:

a) internal components such as valves, bellows, diaphragms, springs etc., are required;

b) heat is applied for only a limited period of time to each specific area or chamber;

c) due to the comparatively small heat absorption area and poor area to volume ratio a considerable amount of heat is required for the engine to function;

d) the same chamber, container or area has to be alternately heated and cooled.

The present invention is not bound by such restrictions; it requires no internal moving components other than fluid and vapor, and embodies a distinct and separate condenser. Heating can be applied continuously to the whole surface area of the array of chambers (hot leg) throughout every revolution, while simultaneously the whole condenser surface area (cold leg) can be continuously cooled.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a rotary heat engine in which the entire array of chambers can be heated.

A further object of the invention is to provide a rotary heat engine in which the need for cyclical heating and cooling of the array of chambers is dispensed with.

A further object of the invention is to provide a rotary heat engine with a separate condenser.

The rotary heat engine of the invention comprises a rotary member mounted for rotation about a horizontally-extending drive axis and a generally annular array of chambers mounted on said rotary member and regularly disposed about said drive axis for absorbing heat from a heat source. The array of chambers is partially filled with liquid and partially filled with gas, and a common condenser is provided for cooling fluid from and exchanging fluid with said chambers. The condenser is distinct from the array of chambers.

The engine further comprises a regular array of passageways each communicating between the common condenser and a respective one of the chambers, the passageways being circumferentially offset from the chambers for selectively trapping gas in chambers on one side of said drive axis. Hence an imbalance of liquid is maintained in the array of chambers which drives the rotary member.

The condenser and chambers are preferably constructed of a strong and effective heat conductive material such as steel, copper or aluminum; whereas the connecting ducts are made of a poor conductive material such as plastic.

The chambers and condenser are mounted and rigidly connected by spokes onto a horizontal axle which extends to supports located at either end. When there is a lateral weight imbalance within the circle of chambers, torque is created which results in rotary motion of the whole device, allowing power to be conveyed through the axle to operate machines including, but not limited to, water pumps, electric generators or grinding mills. The lateral weight imbalance is caused by displacement of a working fluid with which the device is filled in a manner and to the extent that half the chambers and the whole of the condenser are full of fluid, the remaining space being occupied by gas - preferably the fluid's own saturated vapor.

A weight imbalance occurs when a temperature differential exists between the chambers (hot leg) and the condenser (cold leg), such temperature differential being created when heat is applied to the chambers or cooling applied to the condenser, or both. The higher temperature in the chambers results in the production and expansion of vapor therein with a consequent increase in pressure. The connecting ducts are so arranged that on one lateral side the expanding vapor forces out any fluid within the chambers on that side through the ducts into the condenser, while simultaneously on the other upper lateral side there is a concurrent interchange of vapor and fluid, with vapor escaping from the chambers to the condenser while fluid flows freely from the condenser into the chambers. The result is a greater weight of fluid on one lateral side than the other; and this imbalance with its resultant torque and

rotary motion of the device, will continue so long as a temperature differential exists.

If a greater power output is required without increasing the engine's diameter, this can be achieved by extending the width (as measured in the direction of the rotary axis) of the chambers, thereby enabling a greater volume of working fluid to be utilized. The width of the condenser can similarly be increased to achieve the optimum surface area compatible with the amount of working fluid and method of cooling to be used.

Although the engine functions most efficiently when the liquid boils in the chambers rotating upwards, it will continue to operate when the fluid is not boiling, so long as a sufficient temperature differential is maintained between the chambers and condenser. The consequent difference in pressure within the system will always cause a pocket of vapor to form - or some gas to come out of solution - at the top of the chambers rotating upwards. The subsequent heat-induced expansion of such trapped vapor or gas pockets will cause fluid displacement and consequent maintenance of a continuous weight imbalance.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the engine without glass covering, mirrors or shade screen;

Fig. 2 is a cross-sectional view of the engine, with no glass covering, mirrors or shade screen, but containing a filling valve;

Fig. 3 shows a side view of the chambers and condenser, fitted with a glass cover and shade screen which blocks the sun's rays from striking the condenser while allowing clear vertical line of sight from the condenser's upper surface to outer space;

Fig. 4 and 5 are end-on views of the train of chambers with glass covers and two possible configurations of mirror assemblies;

Fig. 6 is a perspective view of one of the vanes fitted on the condenser's surface between the raised edges, and showing the flap valve that can only open inwards;

Fig. 7 is a cross-sectional view of part of the condenser with raised edges, within which are located vanes with one-way flap valves; and showing how some of the cooling water is held by the vanes on one side, but allowed to run freely down on the opposite side;

Fig. 8 is an end-on view of part of the condenser coated with an absorbent covering, onto which water is trickled to maintain dampness;

Fig. 9 shows a section of the condenser fitted with cooling fins;

Fig. 10 illustrates a wire mesh type regenerator fitted within one of the interconnecting ducts;

Fig. 11 shows a cross-sectional view of a differently configured engine to that illustrated in Figs. 1 and 2 in that there are only ten chambers, and the diameter of the train of chambers is less than that of the overall condenser diameter.

Fig. 12 is a perspective view of the engine illustrating a configuration where the condenser is inset, and enveloped by the array of chambers, with the interconnecting ducts having the same width (as measured in the direction of the axle of rotation) as the chambers and enveloped condenser.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1 and 2 the drawings illustrate an engine containing, but not restricted to, an annular array of twelve circumferentially elongated shallow chambers 1, each individually sealed except for respective angled ducts 2 which connect each chamber 1 to an adjacent circular rectangular or similarly shaped sealed shallow condenser 3; such shallowness being utilized to provide efficient surface to volume heating and cooling ratios.

The chambers 1 are elongate in the above direction and in width (as measured in the direction of the rotary axis) in order to maximise the heated surface area; the condenser 3 being similarly configured to maximise the cooling surface area.

The chambers 1 and condenser 3 are manufactured of a good heat conducting material such as steel or aluminum, while the ducts 2 are made of a poorly conducting material such as plastic. The device is secured at both ends by spokes 5 to the axle 4 which is mounted through bearings (not shown) at both ends of the device on support mountings 6 allowing easy rotation of the axle 4 from which power can be transferred, for example by a pulley to any suitable machine.

The outer surfaces of the chambers 1 are treated with a black heat absorbing coating, except for the surfaces facing the axle 4 which, if not absorbing heat by means of additional angled mirrors (not shown), should be covered with an insulating material (not shown) to prevent heat loss. All the surfaces of the condenser 3 are treated with a black coating to enhance heat loss; either by giving up heat to the surrounding air, or, at night, by radiating heat to the heat sink of outer space. To prevent sunlight falling on the condenser 3 a shade screen 8 as illustrated in Fig. 3 is fitted so that the condenser 3 remains in shade during the day but has clear vertical line of sight from its upper surface to outer space at night. Additional components such as regenerators 19 and cooling fins 18 as illustrated in Figs. 9 and 10 can be fitted if required. Regenerators 19 positioned within the interconnecting ducts 2 enhance heat transfer by alternately acquiring heat during the engine's upward rotation and then giving it up to cooled fluid 10 entering chambers 1 on the downward side. Attached fins 18, either horizontal or vertical as illustrated in Fig. 9, increase the surface area of the condenser 3 thereby improving either convective or radiant cooling.

Through the valve 9 as illustrated in Fig. 2 the device is initially evacuated by means of a vacuum pump and then filled with a quantity of low boiling point liquid 10 such as methylene chloride or dichlorotrifluoroethane (a commercially available refrigerant known as SUVA 123 made by DuPont), sufficient to ensure the maintenance of a liquid volume equal to that of the whole condenser 3 and half the chambers 1, the remaining space being occupied by the fluid's own saturated vapor 11.

When sunlight fall upon and heats the chambers 1 - such heating being enhanced by the positioning of mirrors 12 and glass covering 13 as illustrated in Figs. 4 and 5 - the fluid 10 within the chambers 1 boils and the vapor 11 expands. As can be seen in Fig. 2, the positioning of the connecting ducts 2 in relation to the chambers 1 allows vapor 11 in the chambers 1 situated on the left side to escape to the condenser 3 while simultaneously allowing cooled fluid 10 to enter - the internal circumference of the ducts 2 being sufficient to allow the concurrent outflow of vapor 11 and inflow of fluid 10. In contrast the vapor 11 within the chambers 1 on the right side cannot escape, and the increasing pressure due to additional vapor 11 production and expansion forces the fluid 10 out of the chambers 1 into the condenser 3. The result is a greater quantity and weight of fluid 10 within the left side of the device than in the right, thereby creating torque and rotary motion in an anti-clockwise direction. The cycle will continue so long as a sufficient temperature differential exists; with chambers 1 entering the lower right side having their fluid 10 expelled and chambers 1 entering the upper left side being 10 filled under the effect of both gravity and internal pressure while their vapor 11 escapes to the cooled condenser 3 to be condensed back to fluid 10.

The engine can continue to function during the hours of darkness, particularly on hot cloudless nights. While the chambers 1 will absorb heat from the surrounding air and be prevented from radiating such acquired heat away by the glass covering 13, the upper section of the condenser 3 will be cooled by radiating heat to the heat sink of outer space, thus maintaining a temperature differential between the chambers 1 and condenser 3.

As earlier stated, the engine is not limited to any particular number of chambers 1, nor to any particular overall diameter ratio between the train of chambers 1 and condenser 3. Fig. 11 illustrates a variant example of the engine containing only ten chambers 1 and a condenser 3 whose diameter is greater than that of the train of chambers 1 - the opposite of that shown in Figs. 1 and 2 although the mode of operation is identical.

Fig. 12 shows another variant of the engine wherein the condenser 3 is inset and enveloped by the array of chambers 1. In this configuration the interconnecting ducts 2 are widened (as measured in the direction of the axle 4 of rotation) to correspond with the width of the adjacent chambers 1 and condenser 3, thereby ensuring a rapid and even exchange of fluid between them.

The engine can be modified to use water as a coolant, particularly if the device is operating a machine that is pumping water from a well or borehole. As such water is generally colder than the ambient temperature, a portion of the pumped water can be diverted to run over the surface of the condenser 3 in such a way that in addition to cooling the condenser 3 it is also returning some of the energy expended in pumping it to the surface. This is achieved by raising the edges 14 of the condenser 3 and fitting angled vanes 15 with one-way flap valves 16 pivoted about axis P which can only open inwards as shown in Figs. 6 and 7. Similar to a traditional water wheel, water directed onto the top lateral side of the condenser 3 which is revolving downward is trapped in the vanes 15 until the revolution's nadir, at which point the water runs out. But water directed to the other side runs freely down the condenser's 3 surface through the flap valves 16.

Alternatively in order to achieve evaporative cooling the condenser 3 surfaces can be covered with an absorbent coating 17 and water dripped or slowly run over such surfaces - both inner (not shown) and outer as illustrated in Fig. 8. In the engine's configuration as illustrated in Fig. 12. the water would generally be run over the inner surface of the condenser 3, and insulation (not shown) placed between the outer surface of the condenser 3 and inner surface of the array of chambers 1. The resultant evaporative cooling will maintain a lower temperature within the condenser 3 than the chambers 1, particularly in locations subjected to constant breezes and high ambient temperatures.

In windless conditions an air current could be created by utilizing a small amount of power output to operate a fan.

HAVING NOW particularly described and aseertained my said invention and in what manner the same is to be performed, I declare that what I claim is :-

I CLAIM:

1. A rotary heat engine comprising:

   a) a rotary member mounted for rotation about a horizontally-extending drive axis;

   b) a generally annular array of chambers mounted on said rotary member and regularly disposed about said drive axis for absorbing heat from a heat source, said array of chambers being partially filled with liquid and partially filled with gas;

   c) a common condenser for cooling fluid from and exchanging fluid with said chambers, said condenser being distinct from said array of chambers; and

   d) a regular array of passageways each communicating between said common condenser and a respective one of said chambers, said passageways being circumferentially offset from said chambers for selectively trapping gas in chambers on one side of said drive axis to maintain an imbalance of liquid in said array of chambers which drives said rotary member.

2. A rotary heat engine as claimed in claim 1 wherein said array of chambers is exposed to sunlight as said heat source.

3. A rotary heat engine as claimed in claim 2 further comprising a glass member interposed between said array of chambers and incident sunlight.

4. A rotary heat engine as claimed in claim 2 further comprising means for shading said condenser.

5. A rotary heat engine as claimed in claim 1 wherein said liquid has a boiling point below that of water and said gas is the vapor of said liquid.

6. A rotary heat engine as claimed in claim 1 further comprising means for water-cooling said condenser.

7. A rotary heat engine as claimed in claim 1 further comprising means for cooling said condenser by inclusion of cooling fins.

8. A rotary heat engine as claimed in claim 1 wherein said condenser is generally annular and is mounted on said rotary member.

9. A rotary heat engine as claimed in claim 1 wherein said condenser is axially offset from said array of chambers.

10. A rotary heat engine as claimed in claim 1 wherein said condenser is radially offset from said chambers.

11. A rotary heat engine as claimed in claim 1 wherein at least one of said passageways includes a regenerator.

12. A rotary heat engine as claimed in claim 1 wherein said drive axis defines a radial plane, said passageways comprise ducts extending in said radial plane, and said ducts are angularly offset in said plane.

DATED this 06th day of JANUARY 2004

for HONEY & BLANCKENBERG
Agents for the Applicant

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SHEET 1

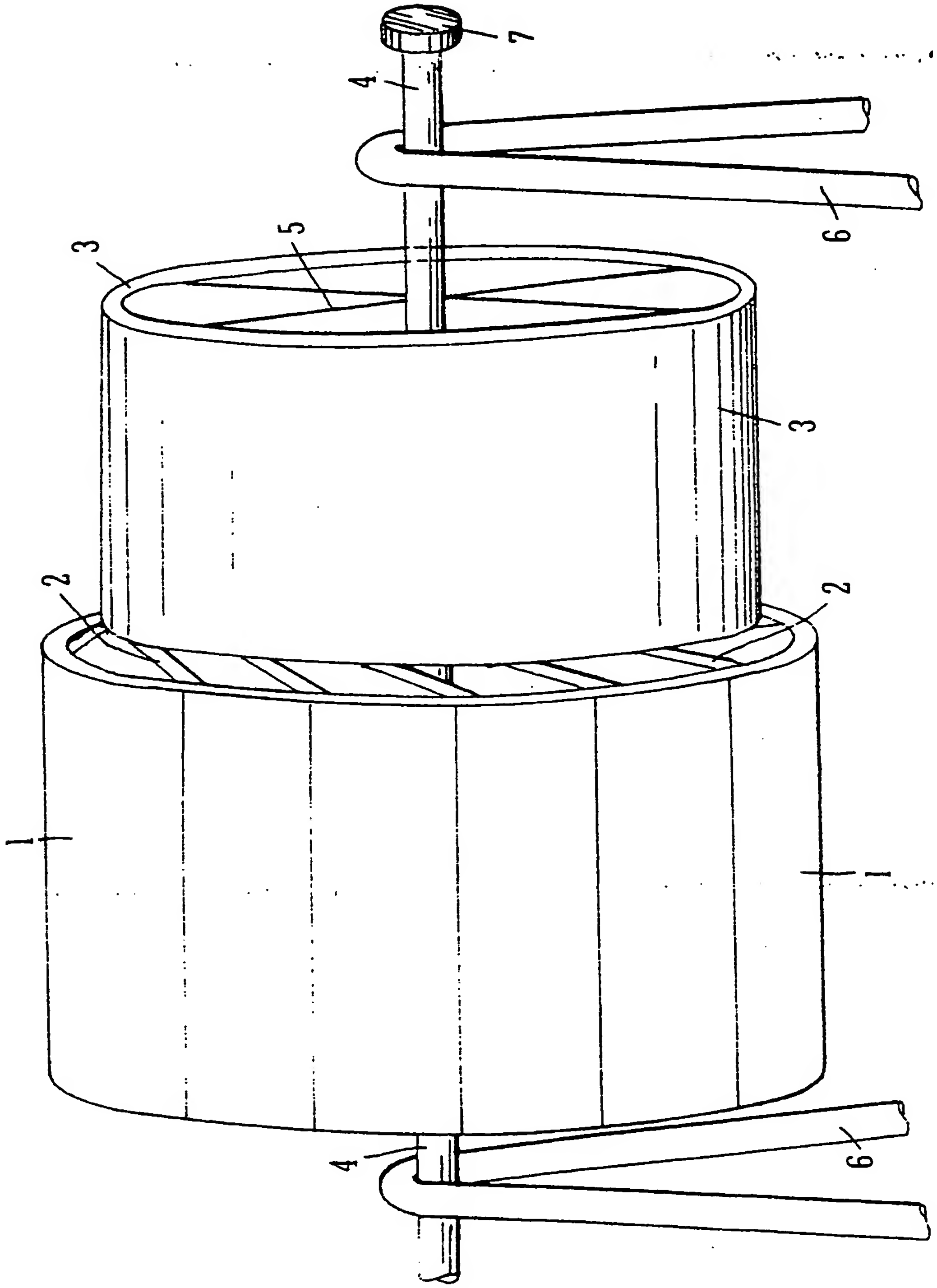

FIG. 1

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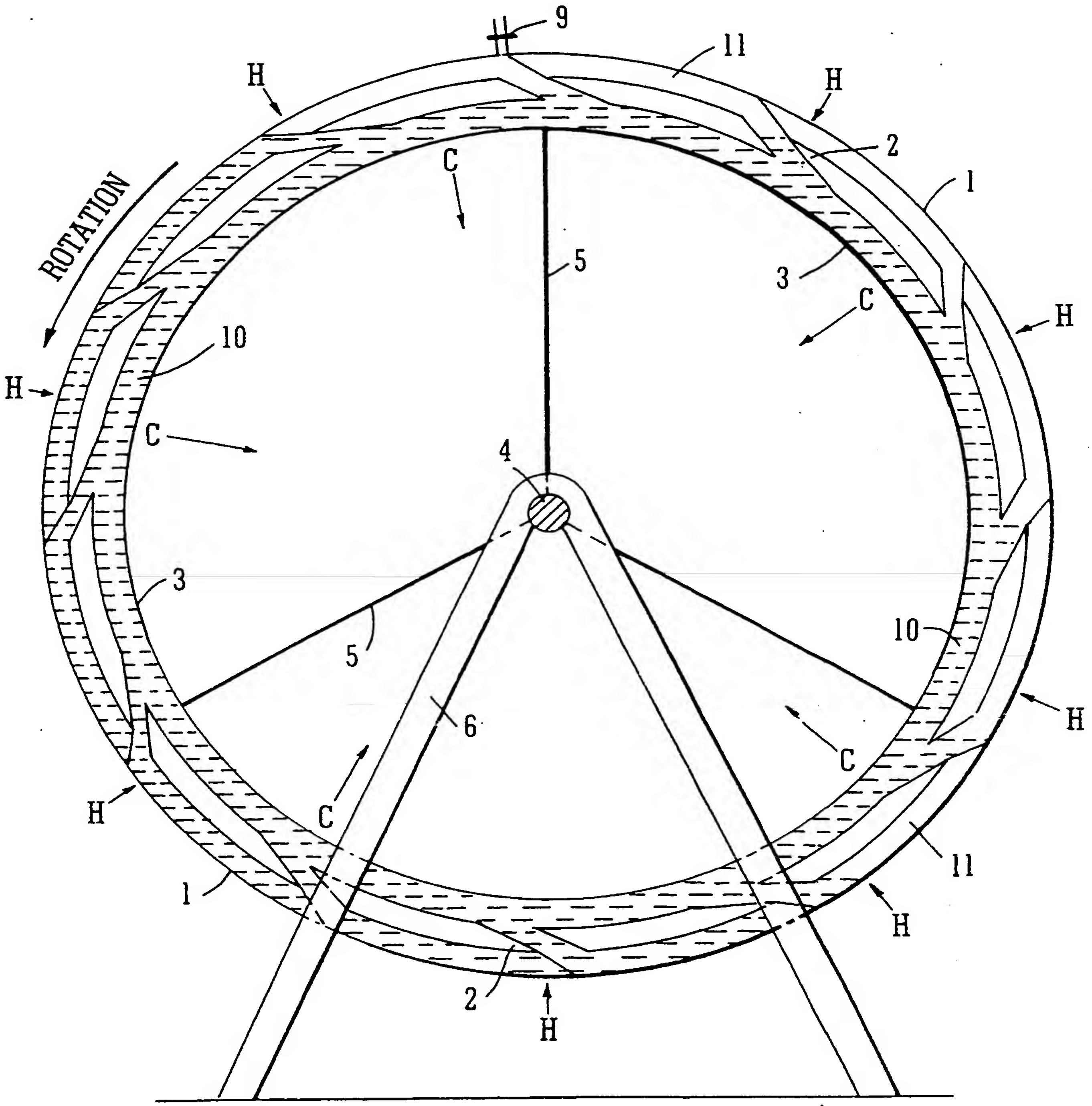
SHEET 2



H ⟶ HEAT IN
C ⟶ HEAT OUT

FIG. 2

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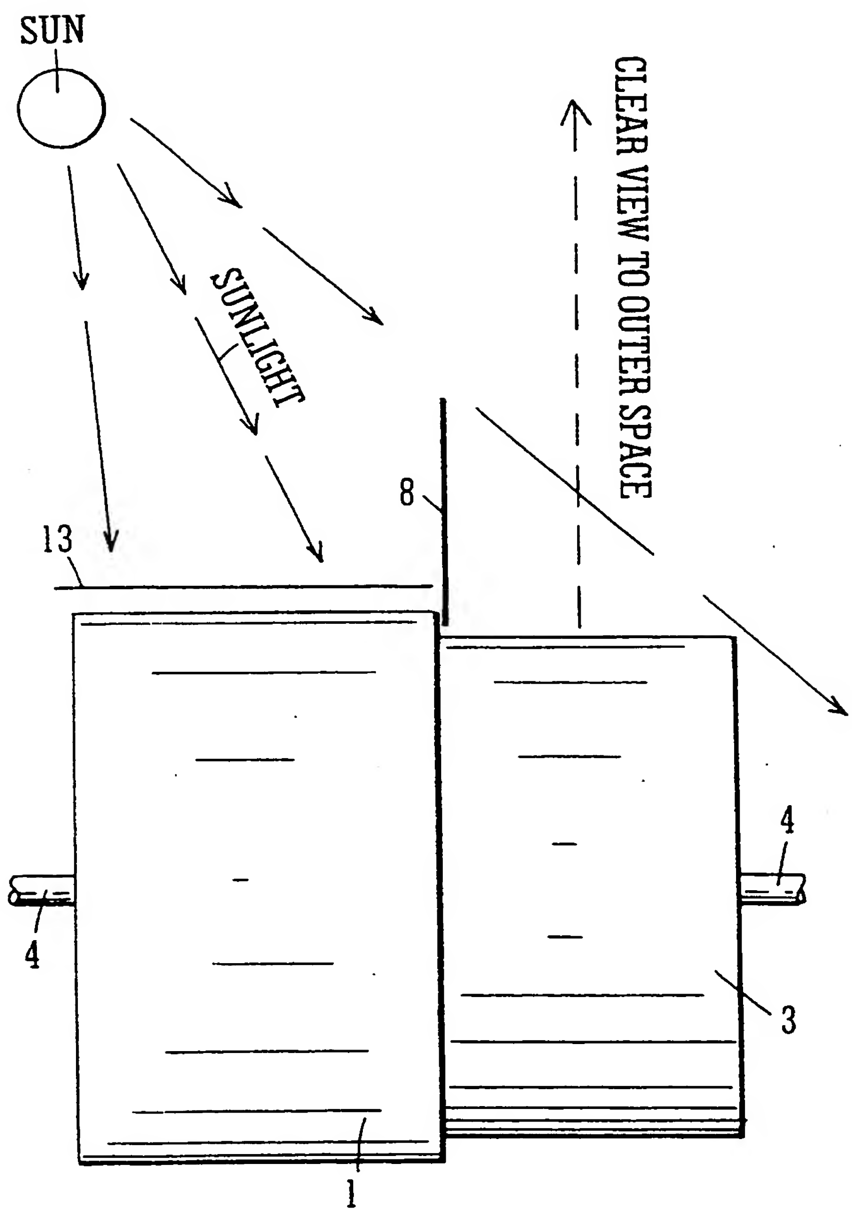

FIG. 3

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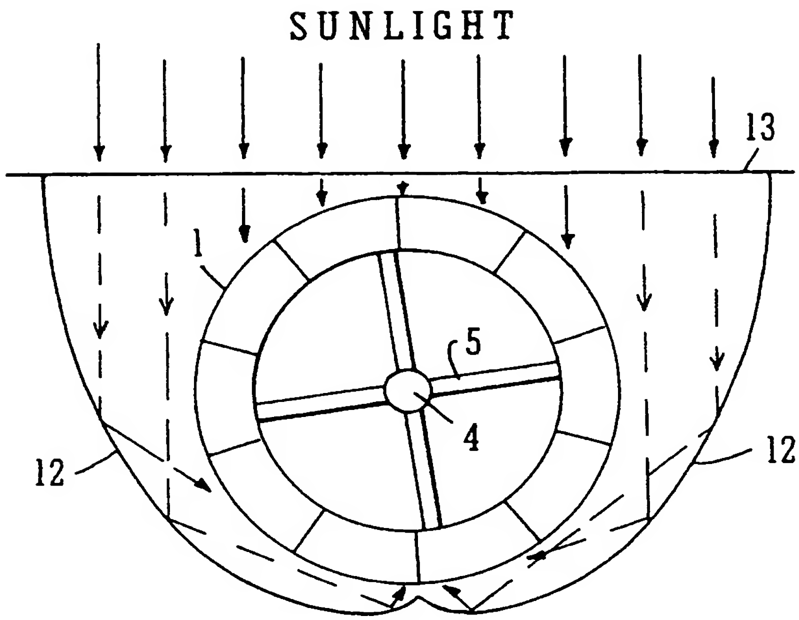

FIG. 4

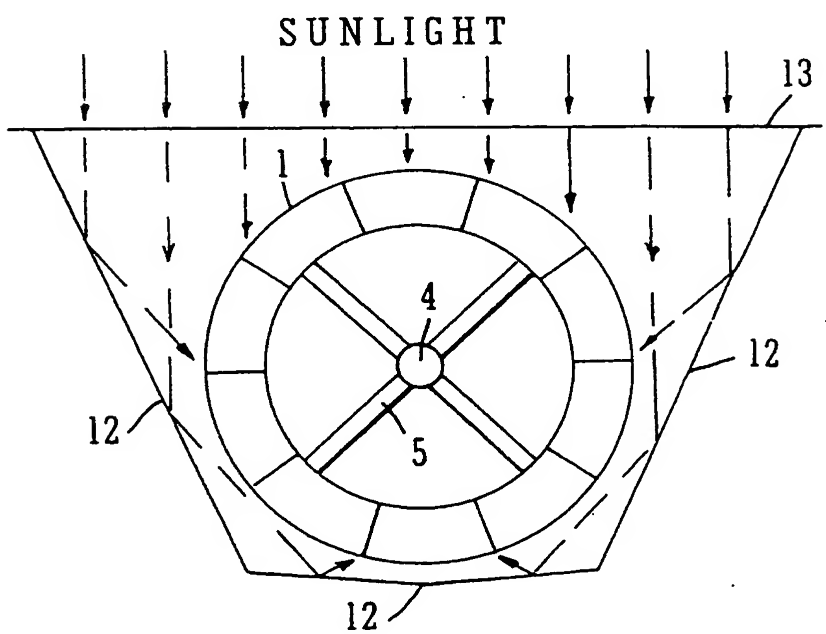

FIG. 5

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SHEET 5

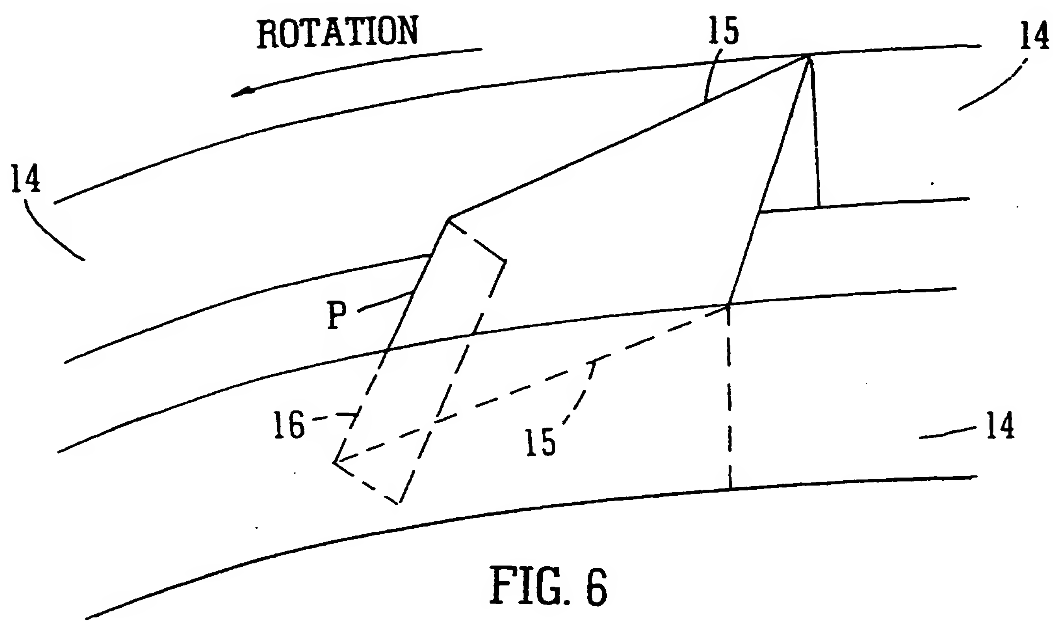

FIG. 6

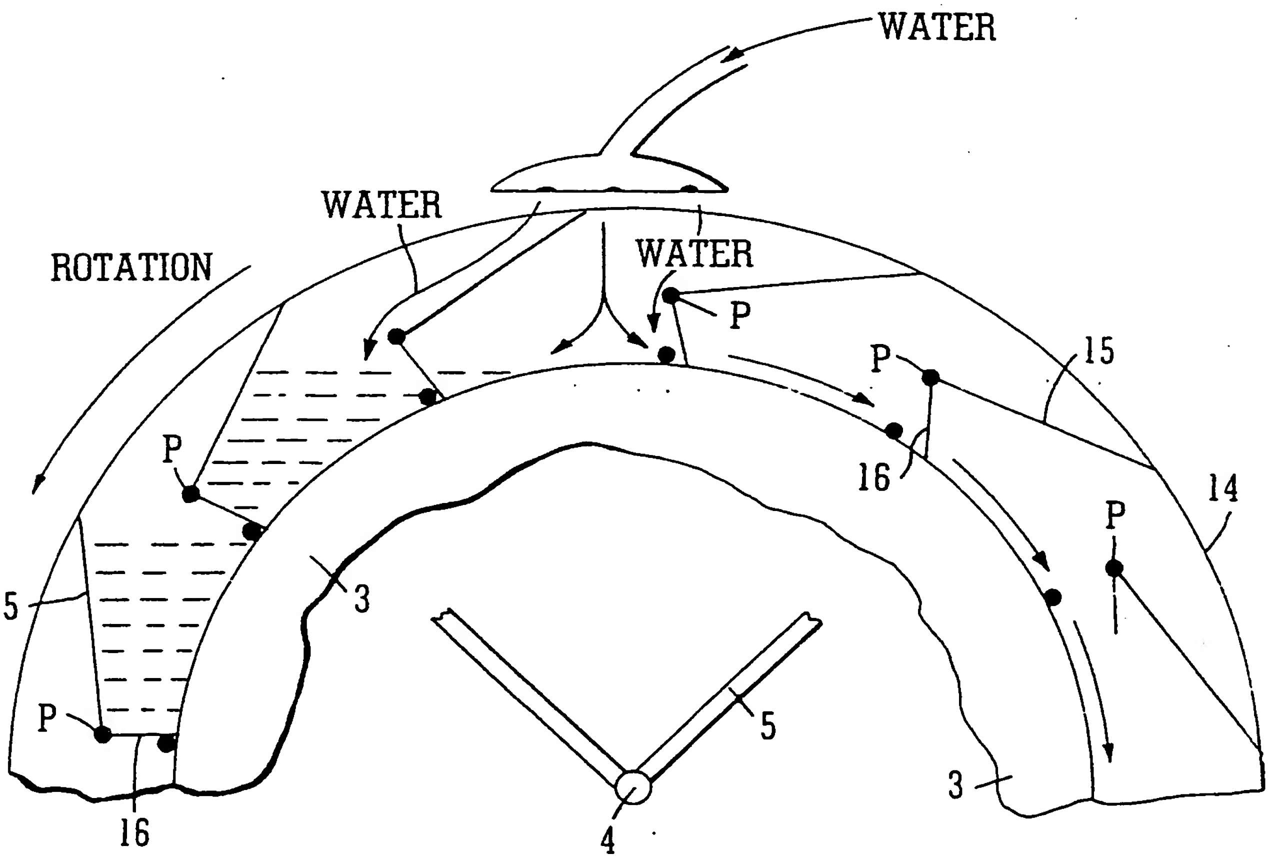

FIG. 7

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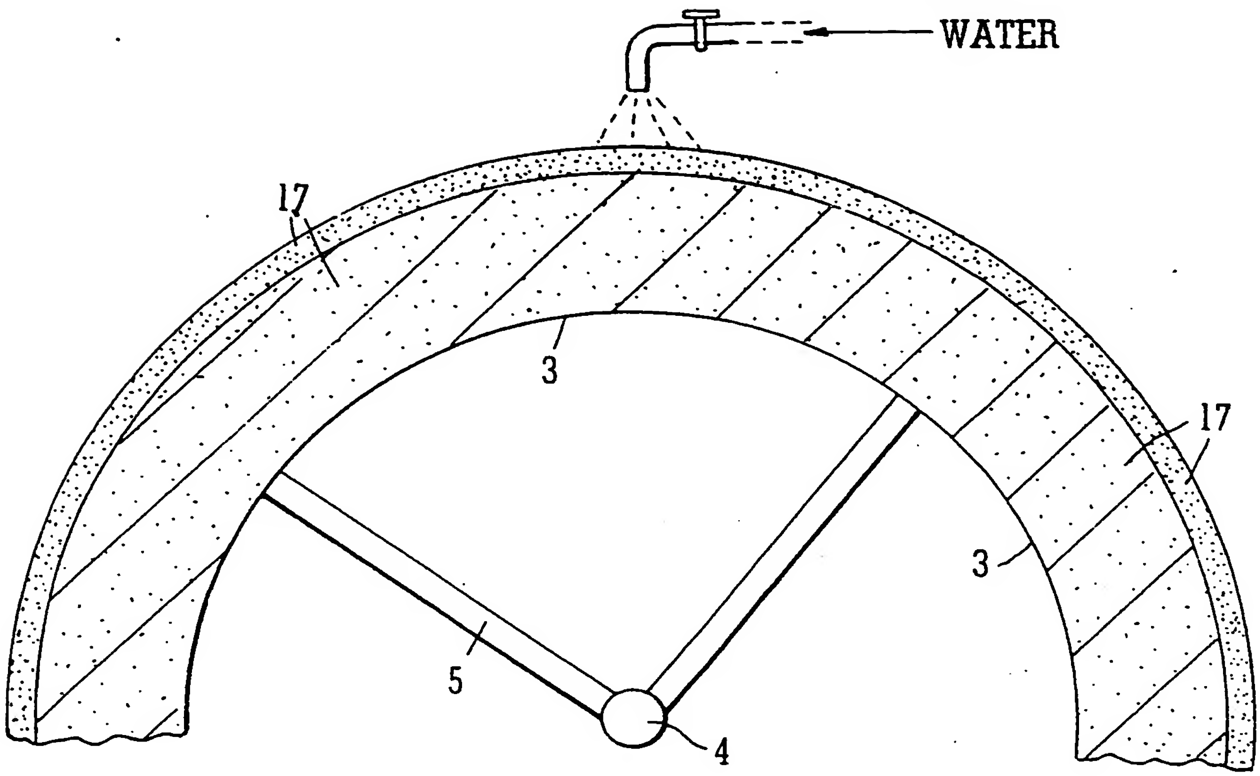

FIG. 8

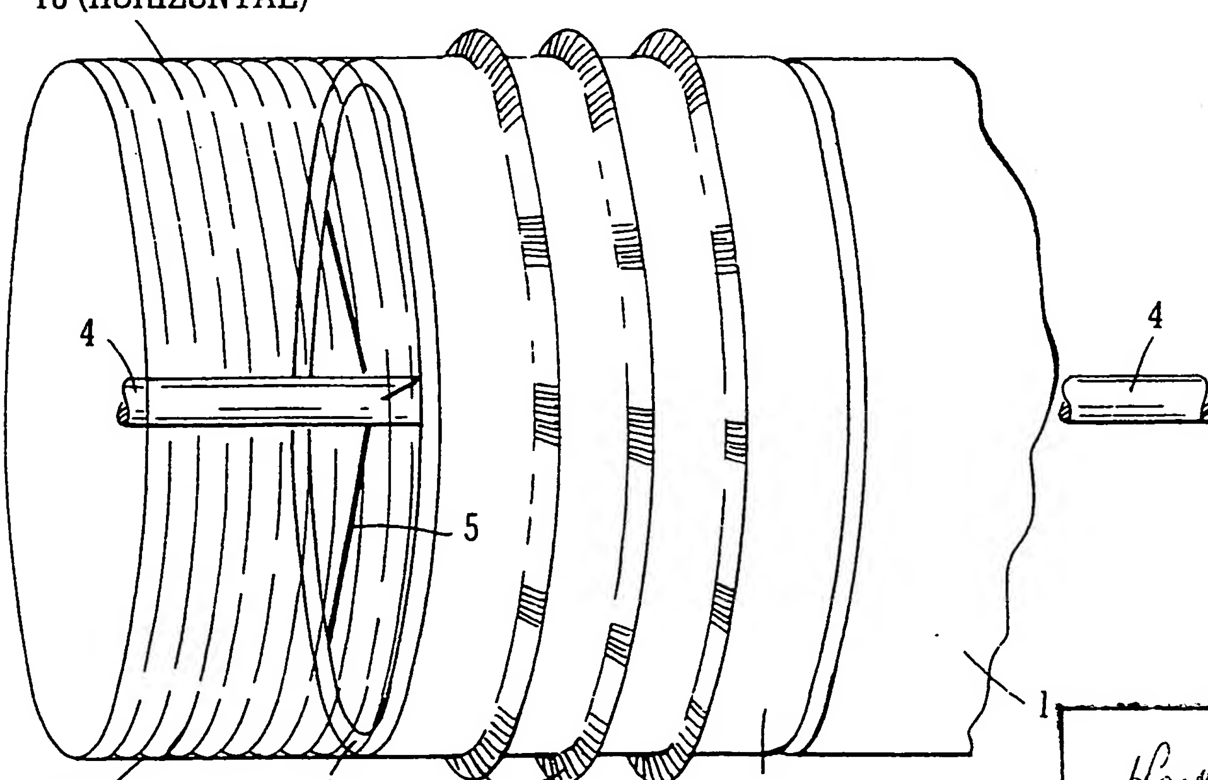

FIG. 9

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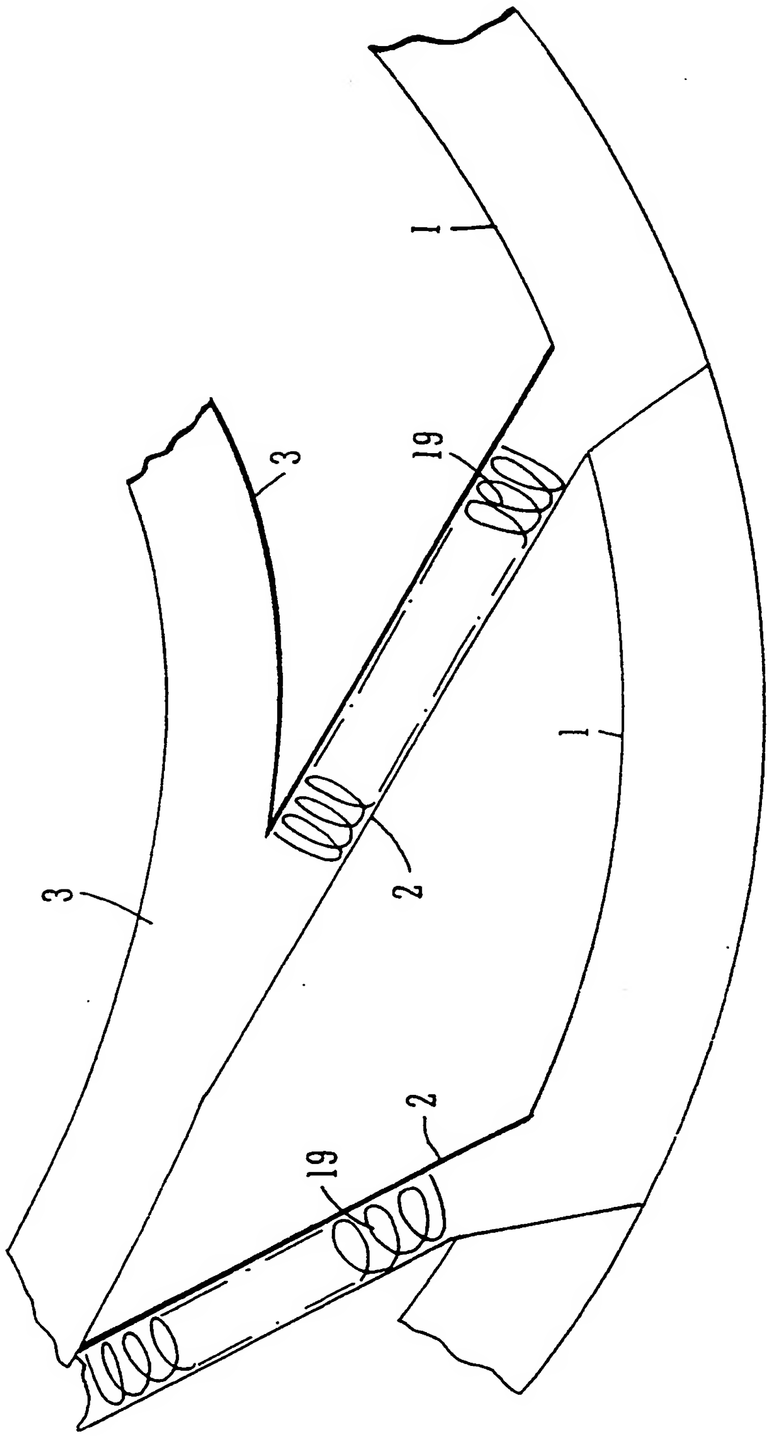

FIG. 10

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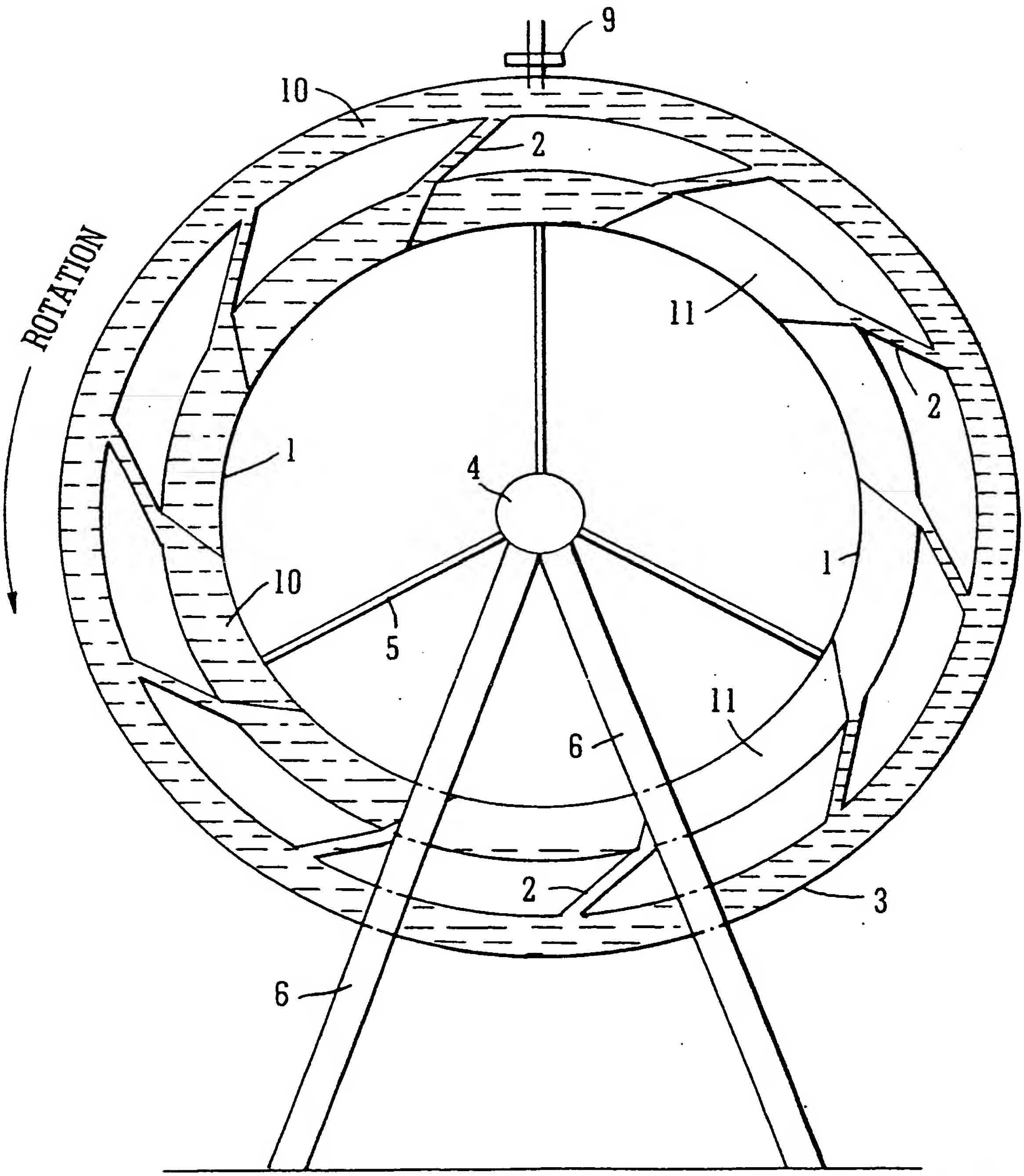

FIG. 11

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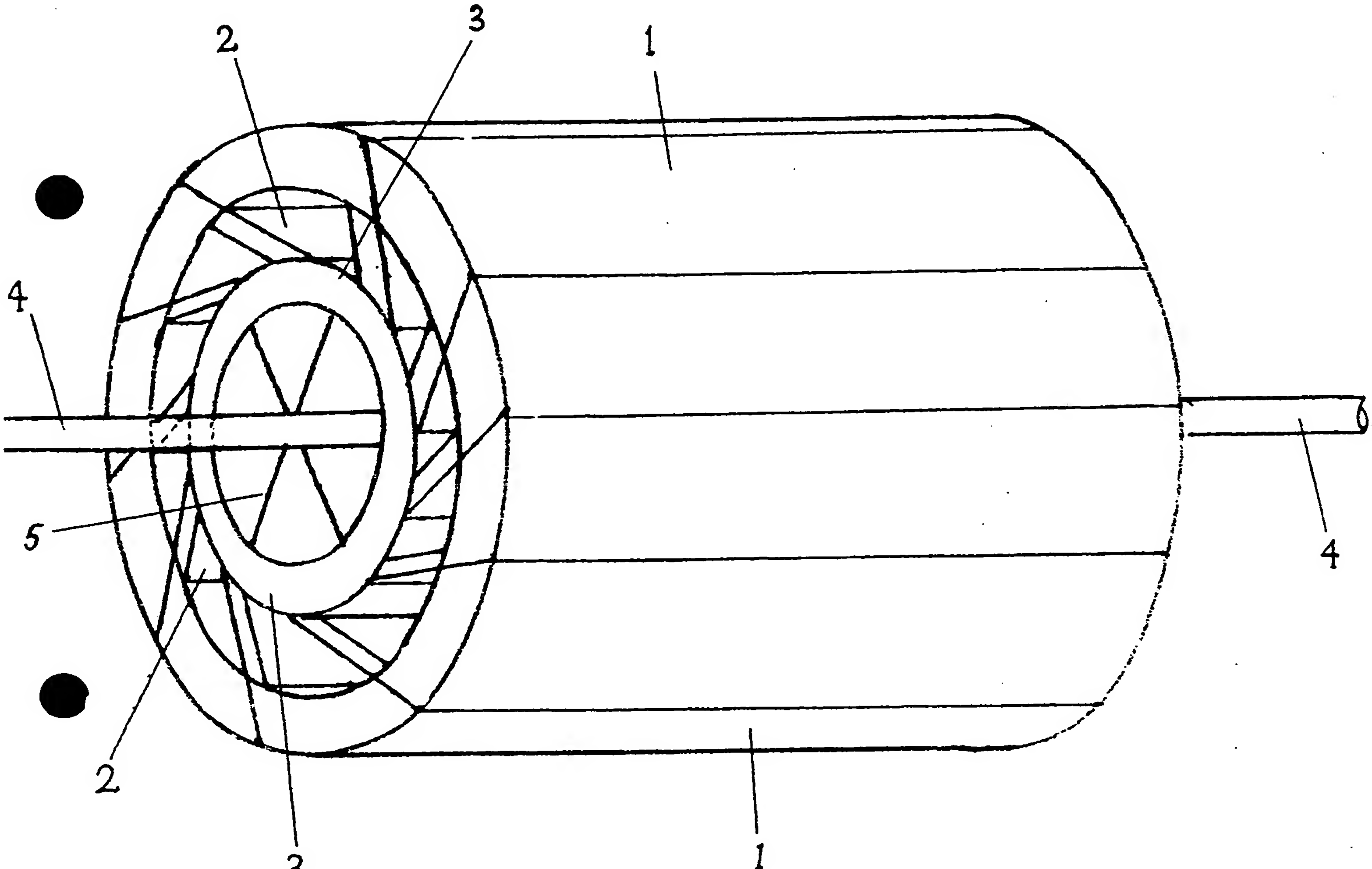

FIG. 12

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